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SUPERMARKET ENERGY USE AND EXPENSE

a tool for identifying where each supermarket stands

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The Food Marketing Institute (FMI) is a non-profit association that conducts programs in research, education and public affairs on behalf of its 1100 members—food wholesalers and retailers and their customers in the United States and overseas. FMI's domestic member companies operate over 17,000 retail food stores with a combined annual sales volume of $120 billion—half of all grocery sales in the United States. More than two-thirds of FMI's membership is comprised of independent supermarket operators or small regional firms. Its international membership includes more than 100 members from 37 nations.

EXECUTIVE SUMMARY

This report provides supermarket operators with a tool to compare the energy use and expense of each store against stores of similar size, location, and fuel-type. The report enables operators to identify "problem" stores—those in need of more extensive energy management. It also presents operators with a framework for budgeting the energy use and expense of new stores and remodels.

The report contains results of detailed information submitted by over 150 companies on up to three of their newest stores, resulting in a data base of 300 of the newest supermarkets in the country. Below are some of the key findings.

1. *As electricity comprises approximately 90% of the energy used in a supermarket, this report focuses on electrical energy use.*

2. *Given the predominance of electricity use in supermarkets, the most appropriate standard of measuring supermarket energy use is kilowatthours per square foot (KWH/sq.ft.).*

3. *Electricity use in supermarkets averaged 59.8 KWH/sq. ft.*

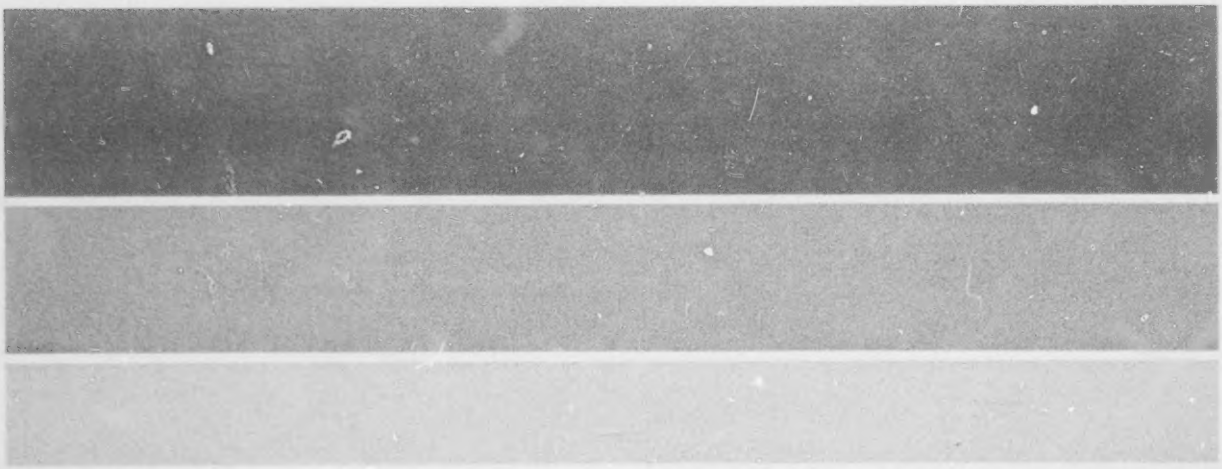
4. *In non all-electric stores, electricity use per square foot declined as store size increased.*

5. *In all-electric stores, electricity use per square foot decreased up to 35,000 square feet, and then increased beyond that size.*

6. *Supermarkets used more electricity in warmer climates than in cooler locations.*

7. *In 1981, supermarkets had a median annual total energy expense of $3.10 per square foot. Over 20% of the stores spent above $4.00/sq.ft., while a like number spent less than $2.25/sq.ft.*

8. *For all supermarkets, the average price of electricity was triple the average price of natural gas, heating oil, or propane.*



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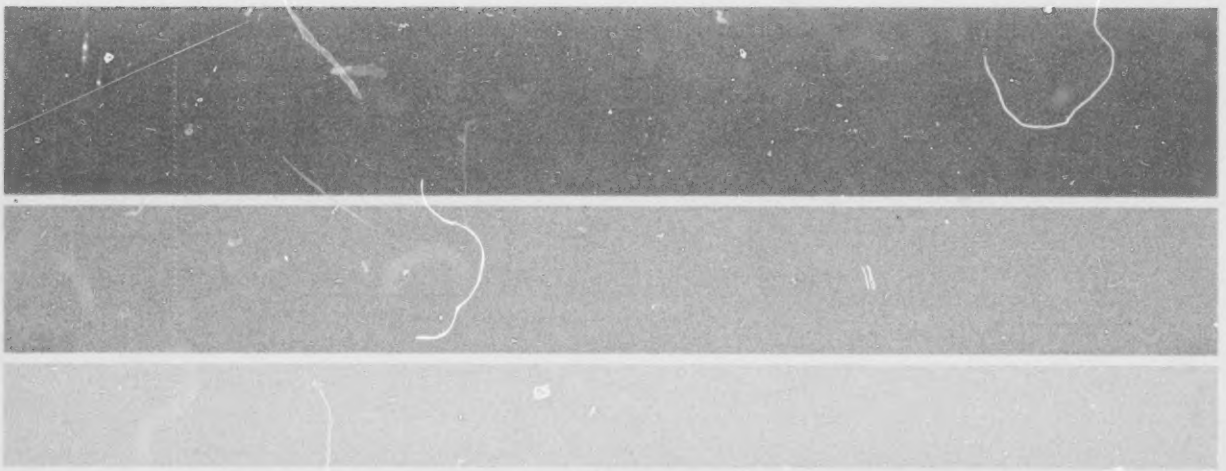


INTRODUCTION

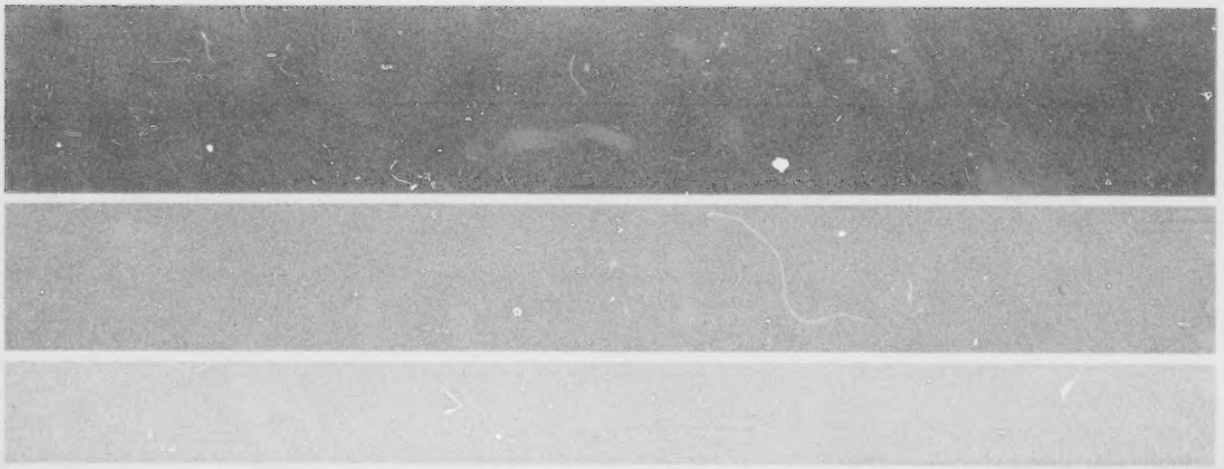
Energy has been a major expense in the supermarket industry for several years. It typically represents more than one percent of sales, in most instances second only to labor in expense, and above rental costs and net profit.

Because energy has traditionally been subject to less stringent controls than other expenses, it does present a unique opportunity to increase store profit by tightening controls. This report is part of FMI's ongoing efforts to place greater emphasis on areas in need of expense control.

Energy is both a major expense and one which is controllable by management. It is similar to any other expense in that it needs to be evaluated in each store, requires management action to keep the expense as low as possible, and should be monitored on a monthly basis. Many supermarket operators have been taking varying actions to reduce energy expense and have been monitoring progress regularly.

This report provides the information needed for management to evaluate the energy expense and use in each store. It is a tool for supermarket operators to compare the energy use of each of their stores against industry averages of new stores of similar size, climate location, and fuel-type.

With this report, operators will be able to identify "problem" stores, those in need of more extensive energy management. Furthermore, operators will be able to develop a budget for both energy use and energy expense of new stores and remodels. But most significantly, this report enables operators to determine where each store stands now, facilitating future conservation efforts and monitoring of results.



REPORT PRESENTATION AND RESULTS

This report is divided into three parts: energy use, energy expense, and energy price. This division is selected because energy expense is the result of the amount of energy used times the price paid for the energy. Of these three components, energy use is the one over which management has the greatest amount of control. It is for this reason that this report focuses on information related to **energy use.**

COMMON STANDARD OF MEASUREMENT

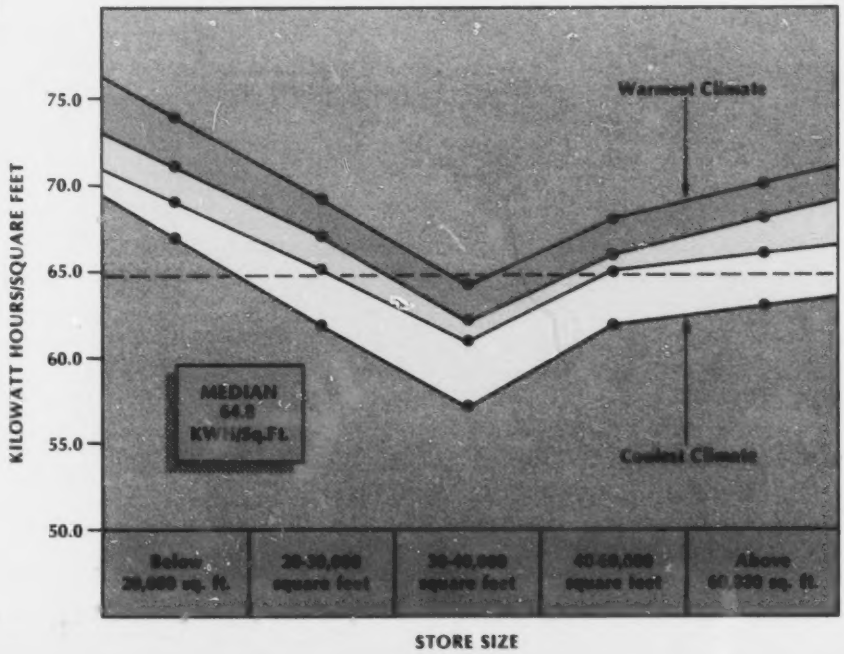
Establishing a common method for measuring energy use is the first step in controlling consumption. This report employs kilowatthours per square foot (KWH/sq.ft.) as its standard measurement.

The measurement method of KWH is applied due to the predominance of electricity use in supermarkets. A sizeable proportion of the supermarket industry is all-electric. For those supermarkets which are not all-electric, approximately 90% of energy use is electricity. For example, heating would be one area where a different fuel is used, but this use generally comprises about 10% of consumption. As electricity is the significant fuel for supermarkets, then, KWH is the appropriate method for measuring supermarket energy use.

As mentioned, KWH in this report is measured by square foot. This technique permits direct management comparison of stores. It is also consistent with the common industry practice of comparing major expenses and sales on a per square foot basis.

GRAPH A

Electricity Use
Median KWH/Sq.Ft.
in All-Electric
Stores



PERTINENT FACTORS AFFECTING ENERGY USE

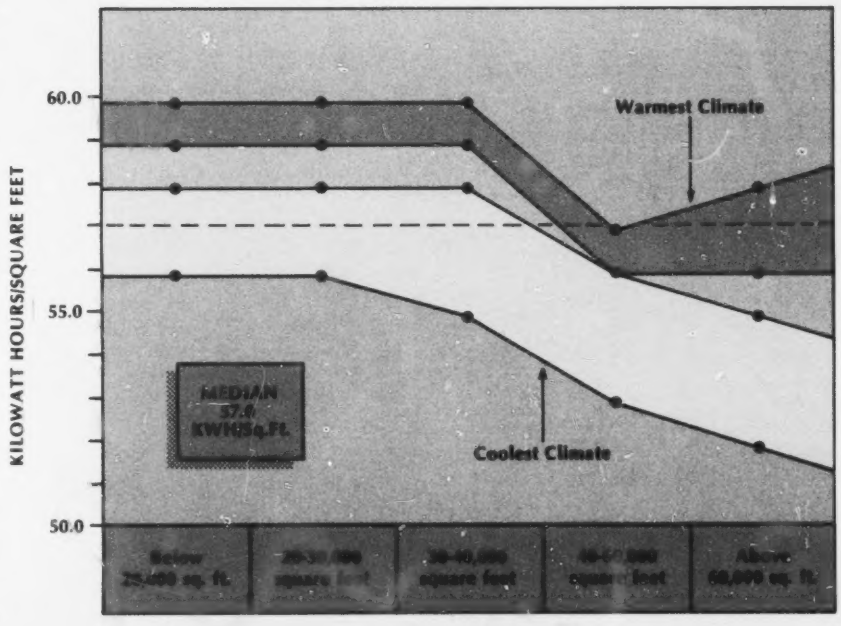
Information on energy use is presented in this report through three main factors of comparison: store size, fuel-type, and climate location. These three principal factors are applied because they are fixed for any existing store. (Other factors affecting energy use appear at the back of this report.) The accompanying graphs present results from this study of the three main factors affecting electricity use, the predominant form of energy used in supermarkets.

The Effect of Store Size and Fuel-Type. The dominant load, at 50-60%, in supermarket energy use is refrigeration equipment. Larger stores tend to be less energy intensive because refrigeration equipment is spread out over more space. There is, however, one exception. Electricity used for heating becomes significant when the heating requirements of the store exceed the capacity of the heat recovery equipment. This point is normally reached as store size increases beyond 35,000 square feet. As seen in Graph A, the energy intensiveness of surveyed stores started increasing between 30-40,000 square feet. For the non all-electric stores represented in Graph B, electricity consumption per square foot generally continued to decline with the increase in store size.

The Effect of Climate. The lines on each graph represent energy use of surveyed stores separated into four climate regions. Stores operating in warmer parts of the country used more electricity than those in cooler areas. These differences are the result of greater load requirements on refrigeration due to heat and humidity. The four climate areas are based on U.S. Department of Agriculture data on mean July temperatures. A summer rather than winter month was selected because refrigeration load requirements are the largest at this time of year.

GRAPH B

Electricity Use
Median KWH/Sq.Ft.
in Non All-Electric
Stores



STUDY METHOD

Over 150 companies returned FMI's questionnaire on individual store energy use and expense, resulting in complete responses on 300 stores in forty-five states, Puerto Rico, and Canada.

To assure a balanced representation of large and small companies in the sample, companies were asked to submit data on no more than three stores. To obtain the most current information, companies were asked to respond with data on their newest stores which had been open for more than a year.

Table A
PROFILE OF SAMPLE STORES

CATEGORY	NUMBER OF STORES	PROPORTION OF STORES
STORE FUEL-TYPE		
All-Electric Stores	116	38.7%
Non All-Electric Stores	184	61.3
Total	300	100.0%
STORE SIZE (000 sq. ft.)		
Under 20	57	19.0
20-29.9	96	32.0
30-39.9	83	27.7
40-59.9	57	19.0
60 and Over	7	2.3
CLIMATE AREA		
1—AK, CAN, CT, MA, ME, MI, MN, MT, NH, ND, OR, VT, WA, WI, WY	78	26.0
2—CA, CO, IA, ID, IL, IN, NE, NJ, NY, OH, PA, RI, SD, WV	133	44.4
3—DC, DE, GA, HI, KS, KY, MD, MO, NC, NM, NV, TN, UT, VA	43	14.3
4—AL, AR, AZ, FL, LA, MS, OK, PR, SC, TX	46	15.3
YEAR BUILT		
1981	53	17.7
1980	63	21.0
1979	30	10.0
1978	20	6.7
1977 and before	48	16.0
Remodeled or Enlarged	86	28.6
STORE HOURS		
Under 70 Hours Per Week	20	6.7
70-79	38	12.7
80-89	76	25.3
90-99	58	19.3
100-109	31	10.3
110-119	23	7.7
120-159	18	6.0
160-168	36	12.0

Respondents were asked a series of detailed questions on each store. Information on fuel use and costs was obtained from utility bills for a full twelve months. Because energy use fluctuates by season, respondents were asked not to project a full year based upon a few months of bills, but to add actual use and costs for twelve months.

Information was supplied on store location and operating hours. Store size data was based upon total ground level area, excluding mezzanines and basements. Questions also covered equipment used in the store, such as types of refrigeration cases, lighting, heat reclaim, deli/bakery, and energy management systems.

Table A profiles the stores included in the sample.

CATEGORY	NUMBER OF STORES	PROPORTION OF STORES
FROZEN FOOD CASES (predominant in store)		
Single-Deck	41	13.7
Glass Doors	54	18.0
Open Multi-Deck	36	12.0
Glass Doors and Single-Deck	65	21.7
Open Multi-Deck with Glass Doors or Single-Deck	104	34.6
DELI/BAKERY		
No Deli or Bakery	67	22.3
Deli Only	27	9.0
Bakery/Deli	206	68.7
SALES AREA LIGHTING		
Fluorescent	231	77.3
HID	68	22.7
Incandescent	1	—
HEATING		
Electric with No Heat Recovery	8	2.7
Electric with Heat Recovery	120	40.0
Fossil Fuel with No Heat Recovery	55	18.3
Fossil Fuel with Heat Recovery	117	39.0
INSTALLED COST OF ENERGY MANAGEMENT SYSTEMS		
None Used	147	49.0
$ Under 10	64	21.3
10-19,999	61	20.3
20-29,999	11	3.7
30-39,999	14	4.7
40 and Over	3	1.0
EQUIPMENT CONTROLLED IN STORES USING ENERGY MANAGEMENT SYSTEMS		
Lights	116	75.8
HVAC	98	64.0
Refrigeration	68	44.4
Other	20	13.1
RESPONDENTS EVALUATION OF ENERGY MANAGEMENT SYSTEMS		
Excellent	47	30.7
Good	77	50.3
Fair	26	17.0
Poor	3	2.0

ENERGY USE

The tables on the following pages provide median energy consumption per square foot for all the supermarkets in the survey. The tables also identify the proportion of stores at varying consumption levels above and below the median. The tables are presented as follows:

- **Tables B1-B4** are for all-electric stores.
- **Tables C1-C4** are for electricity use in non all-electric stores.
- **Tables D1-D4** are for fossil fuel use (natural gas, heating oil, and propane) in non all-electric stores.
- **Each set of tables (B, C, D)** includes four tables (1-4), one for each of four climate areas, with the states included in each area identified at the top of each table.
- **Each table** presents consumption per square foot for five different ranges of store size.
- **Each table** has a work sheet to assist operators in: calculating their consumption/sq. ft. of each store, comparing this consumption/sq. ft. to the median in the table, and calculating the cost of the difference (or excess energy) between the consumption of their store and the median in the table.

HOW TO USE THE TABLES AND WORKSHEETS

To calculate the consumption/sq. ft. of a store:

To Start Turn to the appropriate table for your store. If the store is all-electric, use B tables. If comparing electricity use in a non all-electric store, use C tables. If comparing fossil fuel use in a non all-electric store, use D tables. Then turn to the numbered table representing the climate area in which your store is located. Finally, look in the column representing ranges of store size in which your store belongs.

Step 1 Add up the total energy use from a continuous twelve month period of utility bills. Because energy use varies by season, projecting annual energy use from less than twelve months will not be accurate.

Step 2 Determine the total size of the store, which includes the ground level area of the store, excluding mezzanine and basement.

Step 3 Divide the total energy use by the total store size to arrive at energy use/sq. ft.

To compare the consumption/sq. ft. to the median for similar stores:

Step 4 Compare the median energy use/sq. ft. for stores of your climate area and size against the energy use/sq. ft. of your store from Step 3. Furthermore, determine where your store stands compared to other stores by identifying the proportion of stores which were of similar distance from the median.

To calculate cost of difference from median:

Step 5 Calculate the per sq. ft. excess energy use between your store and the median.

Step 6 Multiply this difference times the total size of your store as listed in Step 2.

Step 7 The result is the excess energy use for the total size of your store.

Step 8 Determine the price paid for energy by dividing the total cost of the energy by the total use. The result is price per unit of energy. Multiply the price per unit times the excess energy use for the total store size.

Step 9 The result is the annual cost to the store of the excess energy use from the median.

TABLE AND WORKSHEET SAMPLE

The worksheet below serves as a guide for using the tables and worksheets. The sample store is non all-electric, located in Pennsylvania, and 30,000 sq. ft. The store operator wants to compare the store's electricity use, which totals 1,899,000 KWH at a cost of $133,499.70 for twelve months.

TABLE C-2

FOR ELECTRICITY USE IN NON ALL-ELECTRIC STORES

FOR STORES IN CLIMATE AREA 2 CA, CO, IA, ID, IL, IN, NE, NJ, NY, OH, PA, RI, SD, WV

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	Under 20	20-29.9	30-39.9	40-59.9	60 and Over
20% were over	67.6	67.6	67.6	65.6	64.6
40% were over	60.0	60.0	60.0	58.0	57.0
MEDIAN	57.8	57.8	57.8	55.8	54.8
40% were below	55.6	55.6	55.6	53.6	52.6
20% were below	48.6	48.6	48.6	46.6	45.6

SAMPLE WORKSHEET

Steps		
1)	Total KWH Use	1,899,000 KWH
2)	Total Store Size	÷ 30,000 sq ft
3)	Divide Step 1 by Step 2 for KWH/sq ft	63.3 KWH/sq ft
4)	Median KWH/sq ft from Table C-2	− 57.8 KWH/sq ft
5)	Step 3 Less Step 4 is per sq ft Excess Energy Use	5.5 KWH/sq ft
6)	Total Store Size from Step 2	× 30,000 sq ft
7)	Step 6 Times Step 5 is Total Store Area Excess Energy Use	165,000 KWH
8)	Price of Electricity/KWH	× $ .0703 per KWH (= cost ÷ use)
9)	Step 8 Times Step 7 is Total Annual Cost of Excess Energy Use	$11,599.50

(= $133,499 ÷ 1,899,000 KWH)

TABLE B-1

FOR: **ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 1: **AK, CAN, CT, MA, ME, MI, MN, MT, NH, ND, OR, VT, WA, WI, WY**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	78.5	73.5	68.5	73.5	74.5
40% were over	70.6	65.6	60.6	65.6	66.6
MEDIAN	67.1	62.1	57.1	62.1	63.1
40% were below	62.2	57.2	52.2	57.2	58.2
20% were below	52.2	47.2	42.2	47.2	48.2

WORKSHEET

STEPS

1) 12 months total KWH use		_____	KWH
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	KWH/sq. ft.
4) Median use/sq. ft. from table	−	_____	KWH/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	KWH/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	KWH
8) Price of KWH	× $	_____	per KWH (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TABLE B-2

FOR: **ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 2: **CA, CO, IA, ID, IL, IN, NE, NJ, NY, OH, PA, RI, SD, WV**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	80.5	76.5	72.5	76.5	77.5
40% were over	72.6	68.6	64.6	68.6	69.6
MEDIAN	69.1	65.1	61.1	65.1	66.1
40% were below	64.2	60.2	56.2	60.2	61.2
20% were below	54.2	50.2	46.2	50.2	51.2

WORKSHEET

STEPS

1) 12 months total KWH use _____ KWH

2) Total store size (ground level, excl. bsmt. & mez.) ÷ _____ sq. ft.

3) Divide Step 1 by Step 2 _____ KWH/sq. ft.

4) Median use/sq. ft. from table − _____ KWH/sq. ft.

5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use _____ KWH/sq. ft.

6) Total store size from Step 2 × _____ sq. ft.

7) Step 6 times Step 5 for total store area excess energy use _____ KWH

8) Price of KWH × $_____ per KWH (= cost ÷ use)

9) Step 8 times Step 7 for total annual cost of excess energy use $ _____

TABLE B-3

FOR: **ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 3: **DC, DE, GA, HI, KS, KY, MD, MO, NC, NM, NV, TN, UT, VA**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	82.5	78.5	73.5	77.5	79.5
40% were over	74.6	70.6	65.6	69.6	71.6
MEDIAN	71.1	67.1	62.1	66.1	68.1
40% were below	66.2	62.2	57.2	61.2	63.2
20% were below	56.2	52.2	47.2	51.2	53.2

WORKSHEET

STEPS

1) 12 months total KWH use		_____	KWH
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	KWH/sq. ft.
4) Median use/sq. ft. from table	−	_____	KWH/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	KWH/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	KWH
8) Price of KWH	× $	_____	per KWH (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TABLE B-4

FOR: **ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 4: **AL, AR, AZ, FL, LA, MS, OK, PR, SC, TX**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	85.5	80.5	75.5	79.5	81.5
40% were over	77.6	72.6	67.6	71.6	73.6
MEDIAN	74.1	69.1	64.1	68.1	70.1
40% were below	69.2	64.2	59.2	63.2	65.2
20% were below	59.2	54.2	49.2	53.2	55.2

WORKSHEET

STEPS

1) 12 months total KWH use		_____	KWH
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	KWH/sq. ft.
4) Median use/sq. ft. from table	−	_____	KWH/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	KWH/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	KWH
8) Price of KWH	× $	_____	per KWH (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TABLE C-1

FOR: **ELECTRICITY USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 1: **AK, CAN, CT, MA, ME, MI, MN, MT, NH, ND, OR, VT, WA, WI, WY**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	65.6	65.6	64.6	62.6	61.6
40% were over	58.0	58.0	57.0	55.0	54.0
MEDIAN	55.8	55.8	54.8	52.8	51.8
40% were below	53.6	53.6	52.6	50.6	49.6
20% were below	46.6	46.6	45.6	43.6	42.6

WORKSHEET

STEPS

1) 12 months total KWH use _____ KWH

2) Total store size (ground level, excl. bsmt. & mez.) ÷ _____ sq. ft.

3) Divide Step 1 by Step 2 _____ KWH/sq. ft.

4) Median use/sq. ft. from table − _____ KWH/sq. ft.

5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use _____ KWH/sq. ft.

6) Total store size from Step 2 × _____ sq. ft.

7) Step 6 times Step 5 for total store area excess energy use _____ KWH

8) Price of KWH × $_____ per KWH (= cost ÷ use)

9) Step 8 times Step 7 for total annual cost of excess energy use $ _____

TABLE C-2

FOR: **ELECTRICITY USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 2: **CA, CO, IA, ID, IL, IN, NE, NJ, NY, OH, PA, RI, SD, WV**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	67.6	67.6	67.6	65.6	64.6
40% were over	60.0	60.0	60.0	58.0	57.0
MEDIAN	57.8	57.8	57.8	55.8	54.8
40% were below	55.6	55.6	55.6	53.6	52.6
20% were below	48.6	48.6	48.6	46.6	45.6

WORKSHEET

STEPS

1) 12 months total KWH use		_____	KWH
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	KWH/sq. ft.
4) Median u e/sq. ft. from table	−	_____	KWH/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	KWH/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	KWH
8) Price of KWH	×	$_____	per KWH (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use		$ _____	

TABLE C-3

FOR: **ELECTRICITY USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 3: **DC, DE, GA, HI, KS, KY, MD, MO, NC, NM, NV, TN, UT, VA**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	68.6	68.6	68.6	65.6	65.6
40% were over	61.0	61.0	61.0	58.0	58.0
MEDIAN	58.8	58.8	58.8	55.8	55.8
40% were below	56.6	56.6	56.6	53.6	53.6
20% were below	49.6	49.6	49.6	46.6	46.6

WORKSHEET

STEPS

1) 12 months total KWH use _____ KWH

2) Total store size (ground level, excl. bsmt. & mez.) ÷ _____ sq. ft.

3) Divide Step 1 by Step 2 _____ KWH/sq. ft.

4) Median use/sq. ft. from table − _____ KWH/sq. ft.

5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use _____ KWH/sq. ft.

6) Total store size from Step 2 × _____ sq. ft.

7) Step 6 times Step 5 for total store area excess energy use _____ KWH

8) Price of KWH × $_____ per KWH (= cost ÷ use)

9) Step 8 times Step 7 for total annual cost of excess energy use $ _____

TABLE C-4

FOR: **ELECTRICITY USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 4: **AL, AR, AZ, FL, LA, MS, OK, PR, SC, TX**

KWH/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	69.6	69.6	69.6	66.6	67.6
40% were over	62.0	62.0	62.0	59.0	60.0
MEDIAN	59.8	59.8	59.8	56.8	57.8
40% were below	57.6	57.6	57.6	54.6	55.6
20% were below	50.6	50.6	50.6	47.6	48.6

WORKSHEET

STEPS

1) 12 months total KWH use		_____	KWH
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	KWH/sq. ft.
4) Median use/sq. ft. from table	−	_____	KWH/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	KWH/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	KWH
8) Price of KWH	× $	_____	per KWH (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TABLE D-1

FOR: **FOSSIL FUEL USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 1: **AK, CAN, CT, MA, ME, MI, MN, MT, NH, ND, OR, VT, WA, WI, WY**

THERMS/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	.82	.72	.67	.62	.57
40% were over	.65	.55	.50	.45	.40
MEDIAN	.61	.51	.46	.41	.36
40% were below	.54	.44	.39	.34	.29
20% were below	.45	.35	.30	.25	.20

WORKSHEET

STEPS

1) 12 months total therm use		_____	therms
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	therms/sq. ft.
4) Median use/sq. ft. from table	−	_____	therms/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	therms/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	therms
8) Price of fossil fuel in therms	× $	_____	per therm (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TO CONVERT

Natural Gas to Therms:
Total number of *ccf* x 1.02
Total number of *mcf* x 0.1, then x 1.0

Heating Oil or Propane to Therms:
Total gallons of heating oil x 1.35
Total gallons of propane x 0.92

TABLE D-2

FOR: **FOSSIL FUEL USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 2: **CA, CO, IA, ID, IL, IN, NE, NJ, NY, OH, PA, RI, SD, WV**

THERMS/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	.72	.67	.62	.57	.52
40% were over	.55	.50	.45	.40	.35
MEDIAN	.51	.46	.41	.36	.31
40% were below	.44	.39	.34	.29	.24
20% were below	.35	.30	.25	.20	.15

WORKSHEET

STEPS

1) 12 months total therm use		_____	therms
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	therms/sq. ft.
4) Median use/sq. ft. from table	−	_____	therms/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	therms/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	therms
8) Price of fossil fuel in therms	× $	_____	per therm (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TO CONVERT

Natural Gas to Therms:
Total number of *ccf* x 1.02
Total number of *mcf* x 0.1, then x 1.0

Heating Oil or Propane to Therms:
Total gallons of heating oil x 1.35
Total gallons of propane x 0.92

TABLE D-3

FOR: **FOSSIL FUEL USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 3: **DC, DE, GA, HI, KS, KY, MD, MO, NC, NM, NV, TN, UT, VA**

THERMS/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	.67	.62	.57	.52	.47
40% were over	.50	.45	.40	.35	.30
MEDIAN	.46	.41	.36	.31	.26
40% were below	.39	.34	.29	.24	.19
20% were below	.30	.25	.20	.15	.10

WORKSHEET

STEPS

1) 12 months total therm use		_____	therms
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	therms/sq. ft.
4) Median use/sq. ft. from table	−	_____	therms/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	therms/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	therms
8) Price of fossil fuel in therms	× $	_____	per therm (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TO CONVERT

Natural Gas to Therms:
Total number of *ccf* x 1.02
Total number of *mcf* x 0.1, then x 1.0

Heating Oil or Propane to Therms:
Total gallons of heating oil x 1.35
Total gallons of propane x 0.92

TABLE D-4

FOR: **FOSSIL FUEL USE IN NON ALL-ELECTRIC STORES**

FOR STORES IN CLIMATE AREA 4: **AL, AR, AZ, FL, LA, MS, OK, PR, SC, TX**

THERMS/SQ. FT.	Store Size Thousand Square Feet				
PROPORTION OF STORES	**Under 20**	**20-29.9**	**30-39.9**	**40-59.9**	**60 and Over**
20% were over	.62	.57	.52	.47	.42
40% were over	.45	.40	.35	.30	.25
MEDIAN	.41	.36	.31	.26	.21
40% were below	.34	.29	.24	.19	.14
20% were below	.25	.20	.15	.10	.05

WORKSHEET

STEPS

1) 12 months total therm use		_____	therms
2) Total store size (ground level, excl. bsmt. & mez.)	÷	_____	sq. ft.
3) Divide Step 1 by Step 2		_____	therms/sq. ft.
4) Median use/sq. ft. from table	−	_____	therms/sq. ft.
5) Difference between Step 3 and Step 4 for per sq. ft. excess energy use		_____	therms/sq. ft.
6) Total store size from Step 2	×	_____	sq. ft.
7) Step 6 times Step 5 for total store area excess energy use		_____	therms
8) Price of fossil fuel in therms	× $	_____	per therm (= cost ÷ use)
9) Step 8 times Step 7 for total annual cost of excess energy use	$	_____	

TO CONVERT

Natural Gas to Therms
Total number of *ccf* x 1.02
Total number of *mcf* x 0.1, then x 1.0

Heating Oil or Propane to Therms:
Total gallons of heating oil x 1.35
Total gallons of propane x 0.92

ENERGY EXPENSE

Table E lists the total annual energy expense per square foot for all stores in the FMI survey. The median 1981 expense for all stores was $3.10/sq. ft.

The figures in the table include the total expense for both all-electric and non all-electric stores. For non all-electric stores, the electricity expense/sq. ft. was added to that of the fossil fuel expense (natural gas, heating oil, or propane). These totals were then included with those of all-electric stores. Store size and climate areas are not included as categories of comparison because the price paid for energy, and ultimately the store energy expense, are more a function of the hundreds of utility companies and their variety of rates.

Example — The annual energy expense/sq. ft. of a 30,000 sq. ft. store with twelve months' utility bills totaling $126,000 is $4.20/sq. ft. This expense is $1.10/sq. ft. higher than the median, and is at a level shared by 20% of the stores. If the store were non all-electric, the electricity expense/sq. ft. would be added to that of the fossil fuel before comparing the total to the table.

Table E

ANNUAL TOTAL ENERGY EXPENSE PER SQUARE FOOT

Proportion of Stores	Expense/Sq. Ft.
10% were over	$4.71
20% were over	4.01
30% were over	3.53
40% were over	3.28
MEDIAN	3.10
40% were under	2.83
30% were under	2.55
20% were under	2.24
10% were under	1.77

ENERGY PRICE

Table F lists the prices paid per unit of energy used for all the stores in the survey. The median price paid for electricity was $.0503/KWH.

For non all-electric store use of fossil fuels (natural gas, heating oil, or propane), the prices listed in the table are the result of converting the unit of measure for each fuel to therms. The median price paid for fossil fuel was $.460/therm.

Operators can make a direct comparison between the price of electricity and that of fossil fuels. To convert the price/therm to price/KWH, multiply by .03414. For example, multiply the median of $.460/therm times .03414. The result is the equivalent price/KWH of $.0157/KWH. This price is three times the median price paid for electricity of $.0503/KWH. This price differential was true for all the stores in the survey.

Example— A non all-electric store has twelve months' total electricity use of 2,220,200 KWH at a total cost of $135,900. Dividing the cost by the use results in a price per unit of $.0612/KWH. This price is $.0109/KWH higher than the median at a price level shared by 30% of the store.

This store uses natural gas for heating, and has twelve months' natural gas use of 13,186 ccf at a total cost of $7,209.20. Converting ccf to therms results in a total use of 13,450 therms. Dividing total cost by total therm use results in a price per unit of $.536/therm. This price is $.076/therm higher than the median at a price level shared by 40% of the stores.

Converting the $.536/therm to KWH to enable comparison, results in a price of $.0183/KWH. This price for natural gas expressed in KWH is over one-third less than the price of $.0612/KWH being paid by this store for electricity.

Table F
ENERGY PRICE PER UNIT

	Fossil Fuel		Electricity
Proportion of Stores	$/Therm	$/KWH (equivalent)	$/KWH
10% were over	$.854	$.0291	$.0700
20% were over	.668	.0227	.0647
30% were over	.562	.0191	.0589
40% were over	.501	.0170	.0540
MEDIAN	.460	.0157	.0503
40% were under	.437	.0148	.0465
30% were under	.408	.0139	.0420
20% were under	.382	.0130	.0378
10% were under	.351	.0119	.0318

Convert Fossil Fuel to Therms

Natural Gas ccf x 1.02
Natural Gas mcf x 0.1 x 1.02
Heating Oil Gallons x 1.35
Propane Gallons x 0.92

Convert $/Therm to $/Kilowatthour (KWH)

$/Therm x .03414

OTHER FACTORS AFFECTING ENERGY USE

Table G provides examples which illustrate that energy use in a supermarket depends upon the equipment which is installed, the way the equipment is used, and store hours.

This list is by no means an inclusive one. It is limited to those factors affecting energy use which could be developed from stores in the survey. Therefore, the variations in energy use should be treated as a general guide rather than a model from which engineering conclusions can be drawn.

The average KWH/square foot for all stores in the survey is 59.8. For each of the factors listed is shown the variation above (+) or below (−) from the average. For example, surveyed stores with fluorescent lighting used 1.0 KWH/sq. ft. or 1.7% less than the average.

Table G

OTHER FACTORS AFFECTING ENERGY USE

FACTOR	VARIATION FROM 59.8 KWH/SQ. FT. AVERAGE	
	KWH/SQ. FT.	PERCENT
Sales Area Lighting		
Stores Using Fluorescent	−1.0	−1.7%
Stores Using HID	+2.6	+4.3
Frozen Food Cases (predominant in store)		
Stores with Tubs and No Open Multi-Deck	−2.1	−3.5
Stores with Tubs and Open Multi-Deck	+2.3	+3.8
Deli/Bakery		
Stores with No Deli/Bakery	−2.8	−4.9
Stores with Deli/Bakery	+0.8	+1.3
Energy Management Systems		
Stores with EMS	−1.1	−1.8
Stores with No EMS	+1.2	+2.0
Heating and Cooking Energy		
Stores Using Fossil Fuel	−2.8	−4.7
All-Electric Stores	+5.0	+8.4
Store Hours Per Week		
Stores Open Less Than 100	−2.2	−3.7
Stores Open 100 and Up	+2.8	+4.7
Age of Store		
Stores Built New 1979-1981	−1.6	−2.7
All Other Stores	+2.6	+4.3

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